先天性色觉异常的特性及检查方法①

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摘要 本文简单介绍了各种先天性色觉异常的特性及常用的色觉检查方法。不同类型的先天性色觉异常在颜色匹配、光谱感受性、色差辨别等方面均表现出不同的特点,色觉检查方法就是在这些特点的基础上,根据异常者的某一色觉缺陷设计的。常用的检查方法有假同色图测验、色相排列测验和色盲镜等。一般来说,不同的检查方法各有所长,并应用于临床的不同阶段

关键词:先天性色觉异常,特性,色觉检查方法

0 引言

作为人类视觉器官三大功能(光觉、形觉和色觉)之一的色觉有正常与异常之分,色觉异常主要表现在患者的颜色匹配、光谱感受性以及色差辨别等方面发生异常。从不同的角度出发,可将异常者分为不同类型。首先,从遗传或起源的角度看,有些色觉缺陷是人一出生就有的,其类型和轻重程度终生保持不变,这类色觉异常称为先天性色觉异常;有些色觉缺陷随视觉器官的疾病继发而来,缺陷的程度与原发病病情的变化相平行,这类色觉异常称为后天性色觉异常。由物理因素和心理因素引起的色视症也属于后天性色觉异常。其次,也可从颜色匹配方面进行分类。正常者为三色性色觉,用红、绿、兰三种原色能匹配出光谱中的所有颜色。而异常者则表现为多种情况,有的人虽然也能用三种原色匹配出各光谱色,但匹配的结果与正常者不同,因而他们是异常三色觉者:也有的人只需用两种原色就能匹配所有光谱色,他们是二色觉者;还有的人进行匹配只需一种原色,通过调整其亮度即能匹配各光谱色,他们是一色觉者。另外,异常者的缺陷还表现在色差辨别方面:红一绿和兰一黄两个辨别轴的辨别力下降。前者称为红一绿异常,后者称为兰一黄异常,完全没有辨色能力的异常类型称为全色盲。由于辨别力下降,异常者的颜色知觉也相应地发生变化。有些人在刺激强度较弱的情况下对光谱上某些颜色的辨别力比较差,这种人称为色弱;有些人不能辨别光谱上的某些颜色或全部颜色,这种人称为色盲。

本文只讨论先天性色觉异常。这里我们首先将先天性色觉异常分为红一绿异常、兰一黄异常和全色盲三种类型,然后进一步将红一绿异常和兰一黄异常分为二色觉和三色觉两种形式。全色盲情况比较特殊,有典型和非典型之分。先天性红一绿异常为眼科较常见的一种遗传性疾病,在我国它的发病率达3%。红一绿异常有红异常和绿异常两种形式,红异常又细分为二色觉性的红色盲和三色觉性的红色弱,绿异常也相应地分为二色觉性的绿色盲和三色觉性的绿色弱。红绿二色觉者能用两种原色(一种是波长小于500nm的短波,一种是波长大于500nm的长波)的不同混合得到各种光谱色;红异常中央窝的相对光谱感受性函数向正常人 $V(\lambda)$ 曲线的短波部分推移,而绿异常的光谱感受性基本正常;此外,红绿二色觉者的波长辨别曲线呈U字形,近495nm波长处于唯一的一个最小值,并且不能辨别540nm以上的波长。红绿异常三色觉者(即色弱者)进行颜色匹配时需三种刺激,但他们所用刺激的比例与正常人不同;其波长辨别位于正常人和相应的二色觉者之间。先天性兰一黄异常的数量较少,约占人口听0.001—0.002%。由于这种异常发病率低,有关它的研究

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并不充分。兰－黄异常也有二色觉和三色觉两种形式。兰色盲可以用两种原色(一种原色的波长在565nm以上,另一种原色的波长在565nm以下)的不同混合得到光谱上的所有颜色,他们的光谱感受性与正常者相似,但波长辨别力在450nm-480nm区域内显著下降。兰色弱同正常者一样进行颜色匹配时也需要三种刺激,只是所用刺激的比例与正常者不同。其波长辨别力的受损程度要比兰色盲轻。全色盲是指颜色视觉完全缺失或严重受损的一种异常类型,它的发病率为0.002－0.003%。根据全色盲是否具有辨色能力,将其分为典型和非典型两大类。典型的全色盲完全没有辨色能力,非典型的全色盲在特定条件下还能作些颜色辨别。

研究色觉异常者的特性除了具有理论价值外,还可为各种色觉缺陷的诊断提供依据。大家知道,对颜色的依赖和使用在人们的日常生活中占有特别重要的地位,它与从事色信号的航海、铁路及必须具备辨色要求的工业、军事、物理、化学、医学、美术等职业关系密切。而色觉异常者由于其色觉缺陷往往不能胜任某些工作,甚至可能在工作中造成严重的事故。根据各种色觉缺陷的特点研制出简例、准确的检查方法具有广泛的应用价值。

1 常用的色觉检查方法

检查色觉的方法有很多,如假同色图测验、彩色物体挑选法、彩色铅笔画线法、灯色法、颜色命名法、测定感色阈法、色相排弄测验及色盲镜等。下面主要介绍假同色图测验、色相排列测验和色盲镜三种。

1.1 假同色图测验

假同色图测验是一种非常流行的色觉测验,它一般要求被试读出或辨别镶嵌在背景中的图形或数字。假同色图测验有很多种,大部分用来区分正常人和先天性红－绿异常者,小部分能识别兰异常和全色盲。

大部分假同色图测验基于假同色原理,利用不同异常类型的颜色混淆特性来鉴别异常者。也有一些测验专门利用相对光效率的个体差异,如利用红色盲长波处明亮度感觉的下降来设计诊断红色盲的测验。假同色图的有效性依赖于选用的颜色、图形和背景所含无素的亮度对比,元素大小等很多因素。这些图的设计各不相同.如图形或数字能被正常者正确读出,但不能被色觉异常者读出;图形或数字被红、绿异常者异读;有两个图形镶嵌在背景中,一个能被正常者读出,一个能被异常者读出;图形只能被异常者读出,正常人不能读等。根据被检查者对各图的辨认情况来判断其色觉是否正常及异常的类型和程度。

在众多的假同色图测验中以Stklling氏假同色图、Ishihara氏色检查表最为流行。我国的研究者也设计出数种色盲检查图.影响最大的当属俞自萍的色盲检查图。

1.2 色相排列测验

色相排列测验要求被试按色调顺序排列一组颜色样品.它能评价正常人和色觉异常者的颜色辨认能力,从而反应出异常者的颜色辨别缺陷。

在评价先天性色觉缺陷方面效度很高的排列测验是Farnsworth(1943)设计的FM100－色调和Farnsworth Panel D-15两种测验及其改进形式[1][2][3]。FM100－色调测验是在明度和饱和度保持恒定的情况下,测定被试色调辨别力。这个测验包括85个色相子,分别装在4个木匣内。测验判断指标有两个——总错误记分和错误轴的方向。总错误记分反应辨色力好坏,总分越高,辨色力越差。错误轴反应被检查者色混淆的情况.可根据错误轴的方向定性诊断色觉缺陷的类型。这种测验的手工记录分析比较费时.但是计算机的应用解决了这个问题——2分钟以内就能显示分析结果。

Farnsworth PanelD--15测验利用的是表面色的直系性,正常人能将一组色相子排成一个圆

环,而异常者则会以不同的顺序排列它们。这个测验包括 15 个色相子,它们都装在一个匣子中。将被检查者的排列结果记在记分纸上,有 2 条或 2 条以上的跨线与红、绿、兰混淆轴相平行的异常者分别定为红、绿、兰色异常;若跨线较多,排列又无规则,则定为全色盲。

后来这两种测验都有一些新版本出现,如 Ohta-色调测验、Roth 28－色调测验、H－16 测验、lanthony 氏减饱和 D－15 测验及 NCT 测验等。它们与前两种测验的原理基本相同,只是所用色调的明度和饱和度有所变化,适用条件也随之不同[4]。象 lanthony 氏减饱和 D－15 测验和 NCT 测验多用于后天性色觉异常。

1.3 色盲镜

色盲镜是一种通过评价特殊的颜色匹配来判断色觉缺陷类型的仪器,其中 Nagel 氏色盲镜专门用来诊断先天性红－绿异常。它除了能区别正常人和红－绿异常者,还能判断异常的类型(是红异常还是绿异常)和程度(是二色觉者还是异常三色觉者)。Nagel 氏色盲镜基于 Rayleigh 匹配,这种匹配是指用红色光和绿色光去匹配各种黄色光。黄色光的纯度、明度不同,红、绿两色光的分量也随之变化。红、绿两色光的配合比值在正常者是一定的,但异常者的比值可大不相同。利用这种红、绿色比值可以判断各类红、绿色盲和红、绿色弱。

检查兰异常需用 Engelking-Trendelenburg 匹配,这种匹配是用兰光和绿光去匹配兰绿光,但这个匹配不象 Rayleigh 匹配,这种匹配是用兰光和绿光去匹配兰绿光,但这个匹配不象 Rayleigh 匹配那样有效。另外,它对黄斑色素密度的变化也很敏感,所以不是一种很好的方法。Nagel Ⅱ 氏色盲镜中包括这种匹配。

除了 Nagel 氏色盲镜。还有一些其它的色盲镜如 Moreland 色盲镜、Besancon 色盲镜、Neitz 色盲镜和 Pickford-Nicolson 色盲镜等[5]。其中 Pickford-Nicolson 色盲镜的检查范围最广,它包括三种匹配:红/绿和黄、兰/绿和兰绿及兰/黄和白。最后一种匹配主要用于评价后天性色觉缺陷。Morelad 色盲镜和 Besancon 色盲镜也包括兰异常的检查。这些色盲镜虽然比 Nagel 色盲镜便宜,但准确性差,对操作者的熟练性要求更高。

2 结束语

由前面的介绍可看出,有关先天性红－绿异常的研究和检查方法很多,而其它两种异常由于发病率低、病例少,尚未进行深入研究。研究异常者特点的最终目的是为了更好地检测出异常者,所以如何设计出既简单、又准确的检查方法是研究者们密切关注的问题。

以上介绍的三种检查方法中,假同色图测验具有简便、价廉、易行等优点,适于大规模的临床普查,但它只能检出色觉异常者,不易判定色觉异常的程度和类型。另外,图形过于简单,被检察者通过默背记忆可能蒙混过关。色盲镜是目前大家公认的最准确的仪器,它除了能区分正常人和色觉异常者,还能正常判断异常的类型(红异常、绿异常或兰异常)和程度(二色觉者或异常三色觉者)。但它价格昂贵,携带不便,需掌握检查技术的熟练人员操作,在各项测定值的计算上比较繁琐,不适于大规模的临床检查,目前只有在对结果的准确度要求很高的情况下才使用这种检查方法。色相排列测验在鉴别色觉异常的程度和类型方面比假同色图好,同时还有价格便宜、易于携带、操作简单等优点,适于大规模的临床检查。但它的准确性不如色盲镜,并且只适用于中等或重度异常者,对程度轻的色弱不能区分。由于三种检查方法各有优缺点,故将其应用在临床的不同阶段,组成一个测验组:先用假同色图检出色觉异常者,再用色相排列测验判断异常的类型和程度,不易判定的类型可用色盲镜检查。Verriest(1968)提出了一组评价先天性异常的测验,其中包托 Ishihara 测验、F2 测验、AO HRR 测验、Panel D-15 测验、Lanthony 氏减饱和 D-15 测验及 Nagel 色盲镜。

近年来国内开展了色相排弄测验的研制工作，这些工作主要集中在Panel D-15。如苌疆[6][7][8](1986,1988)、黄时洲等[9](1995)先后发表了仿制的Panel D-15临床应用情况的报告。苌疆的临床应用结果表明，他们仿制的Panel D-15可以作为鉴别先天性红绿异常的工具。黄时洲分别用他们仿制的D－15测验和国外的Panel D-15测验检查正常人、先天性色觉异常者和眼病病人，发现两种测验结果的符合率很高，说明国产Panel D-15已达到国外Panel D-15的水平，可供临床使用。

研究各种色觉异常者的特性时用的是色光，而假同色图及色相排列测验用的是表面色。表面色多为混合色，在色调、亮度及饱和度方面均不易稳定，这可能也是它们的准确性不如色盲镜的一个原因。如何根据表面色的的特点并结合中国人眼的特点设计出更加合理的Panel D-15测验不失是一个很好的研究方向。

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ANDCUED RECALL TESTS

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96 Chinese characters were used in the experiment. The subjects were 20 collegestudents from Beijing University. Both primacy and recency effects were observed in the immediately free recall tests; and negative recency effects were found in the final overall free recall tests. Robust serial position effects were also observed in the 6 immediate cued—recall tests; but negative recency effects were absent in the final overall cued—recall tests. Theseresults supported the ordinal or contextual theory developed by Bjork and Whitten (1974).

Key words: serial position effects, theprimacy effect, the recency efect, negativerecency effects, ordinal and contextualtheory.

Can THE CHASM BETWEEN THE BRAIN AND THECOMPUTER BE BRIDGED?

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Man's thorough understanding of thehuman brain and its mental process willindicate the occurrence of an event of aphilosophically fundamental nature. Such anunderstanding will be marked by man'ssuccessful simulation and retrieval of themental process. The rise of artificialintelligence as a branch and extension ofneuroscience makes it possible that thechasm between the human brain and thecomputer will eventually be bridged.

Key words: neuroscience, artificalintelligence, neural network.

WHAT AFFECT THE COOPERATION BEHAVIOR

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Cooperation is a typical pro — social behavior. Based on discussing the history of cooperation research, this thesis advocates the theory of representation and aimes at testifying such a theory. 64 boys and girls aged 14 to 17 were involved in either Prisoner's Dilemma Game or Chicken Game for 18 trials under one of four communication—partner conditions. Theresearch results suggested: Anticipatedopportunity to communication enhancedinitial cooperativeness in the PDG situation. The representation of a teacherpartner favoured the establishment ofcooperative interaction; the representation of a student partner led to defensive behavior. In addition, the subject's age, sex and the matrix faced also affected his or her representation system, and these in turn affected thebehavior of the subject. All these suggested that the representation of the subject had existed before the actual interaction began. Under the communication condition, the increase in cooperation behavior could be seen only in those who were willing to use the communication opportunity positively.

Key words: cooperative behavior, communication, partner, representation.

THE MENTAL HEALTH OF COLLEGE AND MIDDLE—SCHOOL STUDENTS IN SHANGHAI AND ITSRELATIONSHIP WITH PHYSICAL EXERCISES

Jiang Biyan, Zhu Beili

With the Abbreviated Profile of Mood States (POMS) revised in China, and the Physical Activity Rank Scale—3 (PARS—3), this study examined college and middle school students' mental health and its relationship with physical exercises. The results of the study showed: 1) many students had high tension, anger, fatigue, depression and confusion, and low vigor andself—esteem; 2) physical exercises were helpful to reduce students' tension, anger, fatigue, depression and confusion, and improve their vigor and self—esteem; 3) physical exercises of moderate to highlevel had better mental health effect; 4) pleasure in sports was closely related tothe persistence in exercises.

Key words: POMS, mental health, quantityof physical exercises.

THE CHARACTERISTICS AND TESTING METHODS OF CONGENITAL COLOR VISION DEFECTS

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This paper introduced brieflycharacteristics of various congenital colorvision defects and commonly used testingmethods used. Different congenital colorvision defects had differentcharacteristics in color match, spectralsensitivity and color differencediscrimination etc.. Based on these characteristics, color vision tests were devised according to one of the color vision defects. The commonly used test methods were pseudoisochromatic plates, arrangement tests and anomaloscops and so on. In general, these testing methods

hadtheir own virtues and were used indifferent clinical stages.

Key words: congenital color vision defect, characteristics, color vision tests.

THE STRUCTURE AND INFLUENCING FACTORS OF PARENTING BELIEF OF MOTHERS OF 2—6—YEAR—OLD CHILDREN

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In this research, 2598 mothers of 2—6—year—old children were randomly chosenfrom each districts of Beijing and weresurveyed about their parenting beliefsystem. The paper holds that: 1) Themother's parenting belief has a structurewith 18 factors; 2) The view of childdevelopment, the expectation of childdevelopment and the view of education arethe three main domains which interact onone another; 3) The child's age, gender andthe mother's educational level, occupation, etc., have significant influence on themother's parenting belief.

Key words: mother, parenting belief, structure, influencing factors.

A RESEARCH OF DIFFERENT LANGUAGES AS AFACTOR IN THE INFORMATION PROCESSING-CAPACITY: A CROSS—CULTURAL STUDY IN CHINAAND GREECE

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This study aimed to investigate different languages as a factor in the information processing capacity. Two groupsof 150 subjects each sampled in China and in Greece were tested respectively. Three Stroop—like tasks were devised to measure the processing speed and control in relation to the verbal, arithmetic andimaginal materials. Three storage tasks and three cognitive task batteries were also involved, addressing to each of the materials. We found that: 1) The Chinese sample performed in the imaginal materialfar better than the Greek sample. 2) In the storage test, the Chinese subjects stored more digits than the Greek ones in allmaterial, which came as a result of the phonological effect.

Key words: informatin processing capacity, speed of processing, control ofprocessing, short—term storage, cognitiveability.

A RESEARCH ON PRIMARY AND MIDDLE SCHOOLTEACHERS' TRAITS AND BEHAVIORIALCHARACTERISTICS

Yang Erzhong
(Shanghai Teachers' College)

The research showed that the majorityof teachers were of positive personalitytype with steady emotion and sound socialadaptibility; the results obtained on the Y—G scale could be used as indicators ofteacher's traits and behavourialcharacteristics.

Key words: Y—G Scale, characteristics, behavior feature.

A PRELIMINARY STUDY OF THE EFFECT OF MENTALDISTANCE IN REGRET PROCESSING

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We re—examined the hypothesis that the mental distance between a counterfactual state and an ideal state is the most important factor influencing the intensity of regret. Our results supported this hypothesis partly and showed other factors apart from mental distance, e.g., the "isolated island effect" which alsoinfluenced regret considerablely. Inaddition, the viewpoint of backward processing about regret was examined inorder to pave the way for the transformation of regret study from the laboratory to real life.

Key words: counterfactual thinking. regret, state. nce, e.g. ,the "

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